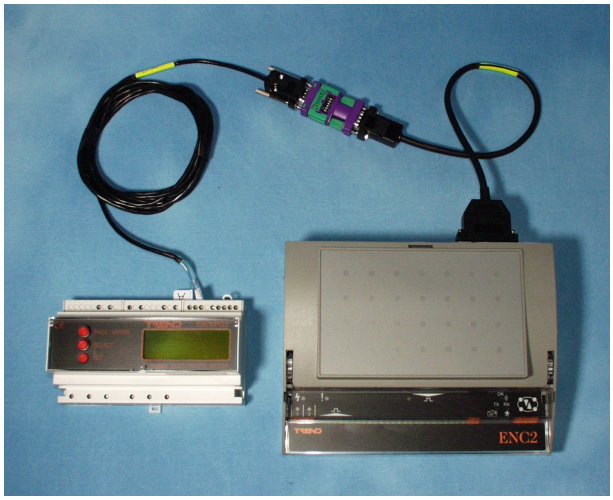
Data Sheet

EM/MPO2, ENC2

Multi-parameter Electricity Meter & Node Controller

MULTI-PARAMETER ELECTRICITY METER, ELECTRICITY METER NODE CONTROLLER



Description

EM/MPO2

EM/MPO2 is an intelligent electricity meter capable of monitoring all electrical parameters related to the supply, including kWh, kVAh, kVArh, max. demand, power factor and frequency. The compact DIN rail mounting housing features a backlit LCD display showing up to 4 parameters simultaneously. The required CT and VT ratios are programmable via recessed push buttons. An RS485 connector cable links the EM/MPO2 to the ENC2 RS485/RS232 convertor. Used in conjunction with the network interface (ENC2, Electricity Meter Node Controller) all logged data can be accessed directly over the Trend network. Ideal for applications where sophisticated analysis of electricity supplies is required, especially on large industrial or commercial sites.

ENC2

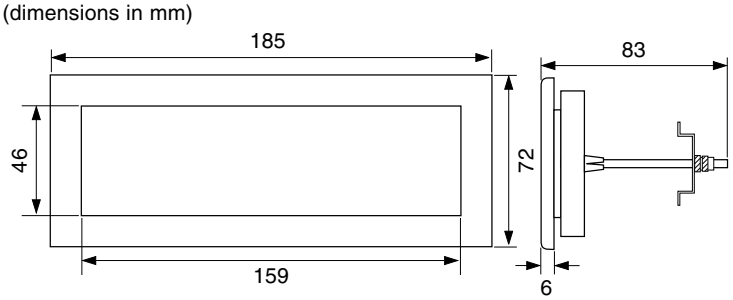
The Electricity Meter Node Controller (ENC2) allows the values presented by the EM/MPO2 to be accessed by Trend devices over the Trend network. It is available in an IP30 enclosure (NBOX) with two supply versions (230 Vac or 24 Vac/dc).

Features

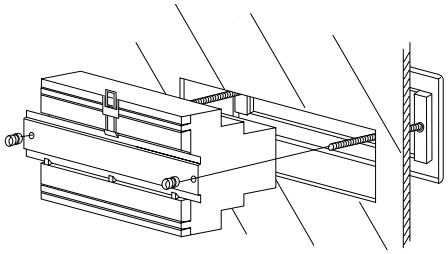
- Multi-parameter metering
- Fully configurable
- Class I accuracy
- Selectable backlit LCD display
- Programmable CT and VT ratios
- Compact, microprocessor-based design
- Split ring CTs available
- DIN rail mounting
- Optional panel mounting kit (ACC/EM/MK)
- RS485 to network interface (ENC2)
- Polarity independent CT connections
- Suitable for use with VTs
- Standard IQ Configuration modules
- Automatic network test
- 116 node addressable

Physical (For EM/MPO2 and ENC2 see next page)

ACC/EM/MK (EM/MPO2 Meter Panel Mounting Kit)
(dimensions in mm)



Note: Panel cutout for kit 180 x 46 mm

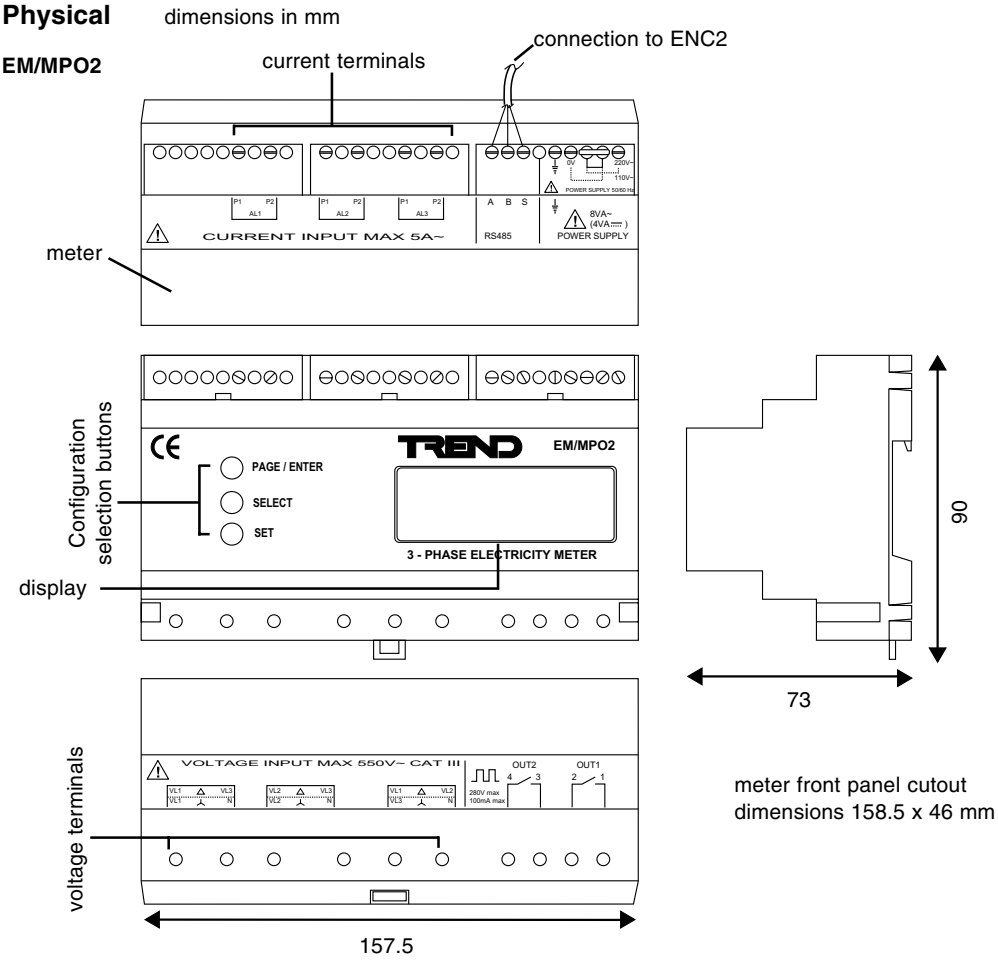


Detail of assembly to meter

Physical

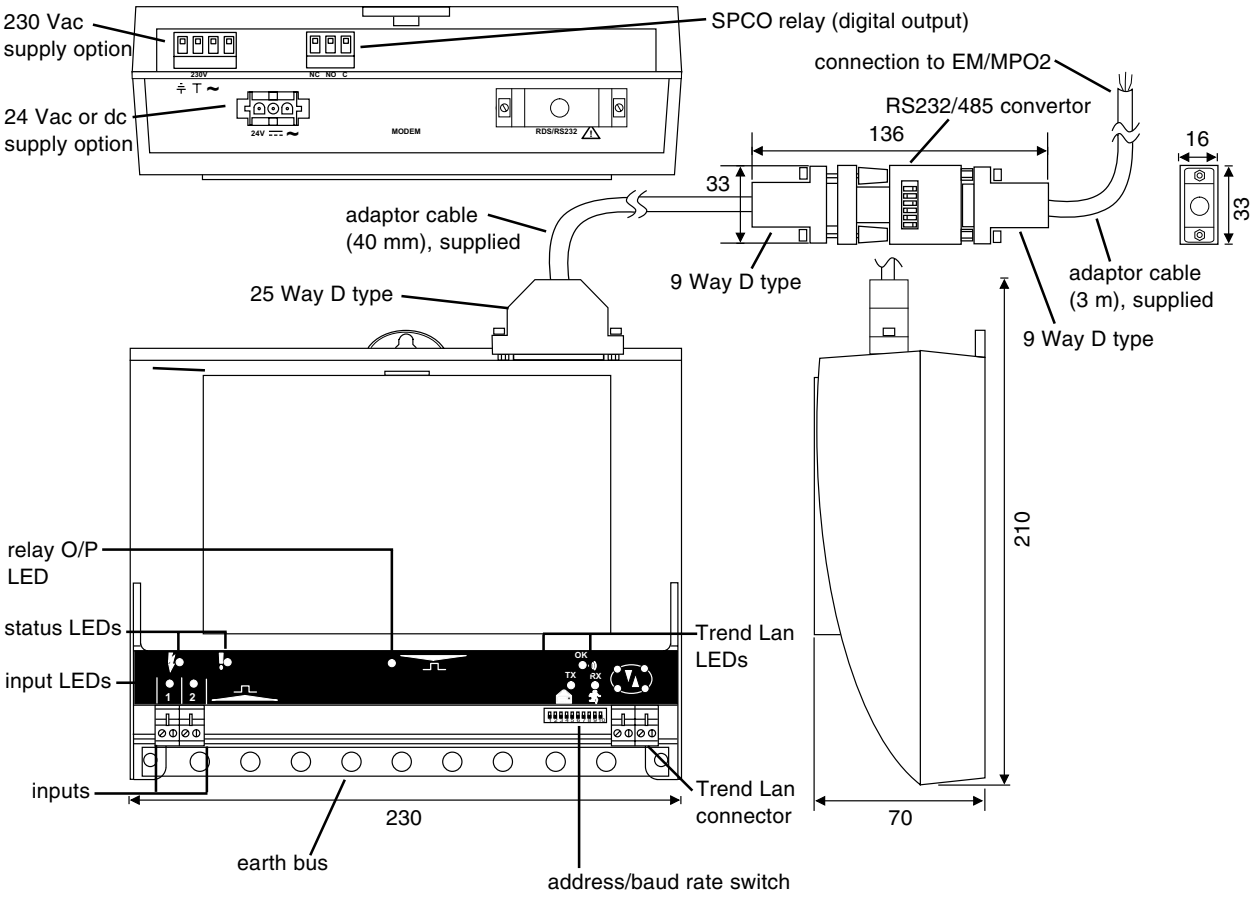
dimensions in mm

EM/MPO2



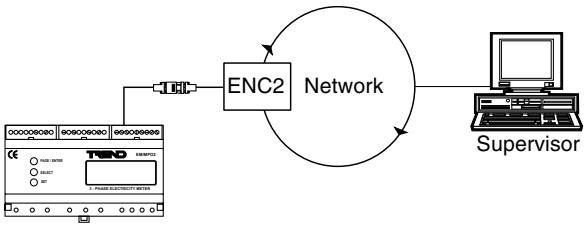
meter front panel cutout
dimensions 158.5 x 46 mm

ENC2



FUNCTIONALITY

The EM/MPO2 and the ENC2 together provide electricity measurements whch can be accessed by Trend devices. The EM/MPO2 takes the measurements and sends them to the ENC2 in standard RS485 interface protocol. ENC2 stores this data in memory and calculates further measurements. Trend devices can then read the measurements from the ENC2 using Trend network communications.



EM/MPO2

EM/MPO2

The EM/MPO2 provides full measurements of electrical consumption including storage of power peaks. The measurements are taken by the EM/MPO2, and sent directly to the ENC2 via an RS485 cable. The unit is shipped with default settings, and minimal programming is necessary.

Hardware

Enclosures: The EM/MPO2 is provided in an enclosure for mounting on a DIN rail. An optional panel mounting kit (ACC/EM/UK) is available.

Front Panel: The meter front panel provides access to the measurements on display pages, accessed easily from selection buttons. The display also allows the unit to be programmed.

Data Backup: In the event of a power failure, maximum demand, energy meters, setup, and clock are protected by means of the internal EEPROM.

Terminals: The voltage and current terminals take a maximum wire gauge of 2.5 mm^2

Power: The EM/MPO2 requires 100 to 120 Vac, or 200 to 240 Vac.

RS485 Output: The unit provides a standard RS485 output to transmit the measurements to the ENC2 which can be up to 3 m away. The communication is set by default to 9600 baud, 1 stop bit, no parity. The number of stop bits has to be changed to 2 during the installation process for correct operation with the ENC2.

Reset: The energy counters (kVArh and kWh) and power peaks (average, apparent kVA and active kW) can be reset using a front panel button. The power peak values are not valid for the integration time (default = 15 mins) after switch on or reset

Firmware

CT, and VT Ratios: The EM/MPO2 will measure current up to 6A directly (above this CTs are required) and up to 550 V directly (above this VTs are required).The CT, and VT ratios are easily programmable from the front panel. The meter supports a selectable CT primary rating of 1 to 999999 A and secondary of 1,2,2.5, or 5A, and VT primary rating of 1 to 999999 Volts and a secondary of 57.7, 63.5, 100, 115, 120, 173, 190, 200, and 220 volts.

Measurements: The EM/MPO2 measures Volts, Amps, W, P.F.cos ø, VAr, VA, Hz, kWh, kVarh, VA Peak, W Peak, Average kW, Average kVA, Average kVar, Crest Factor (1/THDF), Date, and Time. It supports LV, MV, and HV measurements connected in star, and delta configurations.

Configuration: The unit is configured from the front panel using the buttons as explained in the VIP Energy User Manual.
The RS485 interface number of stop bits is set by default to 1 and **must be changed to 2**. The power peaks (average, apparent kVA and active kW) integration time is set by default to 15 mins and should be reconfigured if required over 30 mins.
The other defaults will operate successfully in most cases, but transformer values must be set up if CTs or VTs are used. The measurement is configured for Star connection by default and may have to be changed to Delta.
A summary of meter configuration is provided in the EM/MPO2 Installation Instructions (TG200269), and full details are given in the VIP Energy User Manual supplied with the EM/MPO2.

ENC2

The ENC2 allows an EM/MPO2 to be connected to the Trend network. It stores values received from the meter, making them available to other devices on the Trend network. Some values are calculated within the ENC2 using readings received from the meter.

The ENC2 consists of a customised IQ22x controller with an RS232/RS485 convertor module connected to the specially modified RS232 port, and a dedicated script program (TCL) which performs the necessary communications and calculations to produce the measurements in the IQ controller analogue array. It also has further modules configured so that some of the measurements are identified by label and additional measurements are calculated within the ENC2.

Hardware

Unit: The ENC2 is supplied in a plastic enclosure with a transparent plastic flip-up terminal cover. It has a 3 point mounting to facilitate installation. It has an RS232/RS485 converter connected by cable to the RS232 connector at the rear of the unit.

Connectors: Two part connectors are used throughout to facilitate wiring. A busbar is provided for screen termination.

Power: 230 Vac 50/60 Hz (/230 option), 24 Vac or 24 Vdc (/24 option).

Fusing: The controller has no replaceable fuses; protection is provided by a self-resetting thermally protected transformer.

Indicators: LED indicators for receive and transmit network current flow (RX, TX) and network OK ( ), also for all I/O channels, power ( ), and watchdog ( ). See specification section for details.

Network: The 2 part network terminals facilitate connection of 2 wire cables.

Address Switch : The ENC2 device address on the local Lan is selected by address switch poles 1 to 7. The TCL program requires that the next address (i.e. address switch setting plus 1) is also allocated to the ENC2. Therefore the address switch may only be set in the range 4 to 8, 11 to 118 and both the setting and the setting plus 1 must be unique on the local Lan.

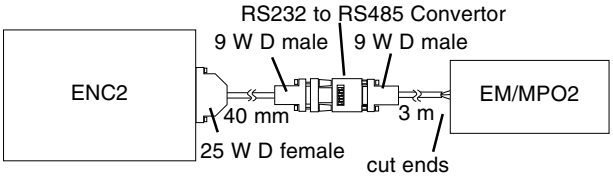
Baud Rate Switch : The local Lan baud rate is set by address switch poles 8 to 10 to 19k2, 9k6, or 1k2. The local Lan baud rate must be set to match other nodes on the local Lan.

Network bypass relay: In order that the network continues to operate if the ENC2 fails, a node bypass relay is fitted to maintain network integrity in the event failure of the node's power supply, or failure of the node itself. The bypassing of a node will be recognised by the downstream node, and reported as a Lan Changed alarm.

Battery Backup: Details about the strategy configuration, time and date, and logged data are stored in RAM. A plug-in lithium cell provides power to maintain the data in the event of power failure, or the controller being switched off.

ENC2 Hardware (continued)

RS485 to EM/MPO2: The RS232/RS485 convertor module is connected to the rear of the unit by means of a 40 mm 25 way female D connector to 9 Way male D connector cable. The convertor module is connected to the EM/MPO2 by a 3 meter screened 9 way male D connector to open ends 2 wire cable. Both of these adapter cables are supplied with the unit.



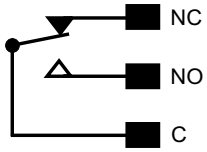
The interface module has DIP switches which are set by default to operate correctly with the ENC2-EM/MPO2 system. **They should not be changed.** They are set as follows:

Pole	Setting	Function
SW1	ON	2 wire
SW2	OFF	RXEN
SW3	OFF	TXEN
SW4	ON	ADE2
SW5	OFF	ADE1
SW6	OFF	ADE0

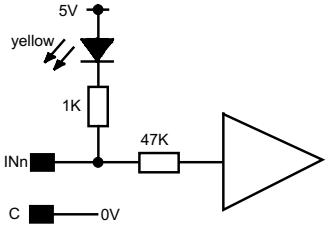
Note: The internal wiring to the rear RS232 plug is non-standard and is only intended for the ENC2 application. If any other device were to be connected to this plug, damage may occur.

I/O channels: The ENC2 is supplied with 2 digital input channels, and 1 digital (relay) output channel.

Digital (Relay) Output
(external channel unnumbered, configuration channel OP8)



Digital only inputs
(external connection inputs and configuration channels 1,2)



COMPATIBILITY

Supervisors: 94x series, 921, S2, 962, Viewpoint.
Utility software: PowerTool, 822+/Toolbox version 6, 841 Strategy Browser (Vx), 842 Change Tracker, SET.
Controllers: It can communicate to other Trend IQ controllers using inter-controller communications.

Strategy files: A certain amount of configuration is present in the ENC2 so if a strategy file is downloaded into the ENC2, the pre-configured data will be lost. The IQ2 v1.0 firmware supports .IQF file format and thus will not accept files uploaded from IQ2v2 or above. The IQ Configuration Reference Manual Addendum covers the compatibility between different types of strategy files.

Sensor Logs: The IQ Configuration Reference Manual Addendum covers the compatibility between the ENC2 sensor logs and supervisors and software tools.

Compatibility with EM/MPO+: The EM/MPO2 parameter values received from the meter have different units as follows: sensors 3, 11,12,13, are W instead of kW, and sensors 14 and 15 are now VA and VAr instead of kVA and kVAr. The ranges (i.e maximum values that parameters can take) available in the EM/MPO2 are much larger than those on the EM/MPO+.

Compatibility with old RS232/485 convertor: The old grey convertor (K485-ADE) plugged directly into the back of the ENC2 via its 25 Way D type). It can be plugged into the new ENC2 but its old cable (9 Way D female to cut ends, 2 wire, EJ104355) must be used to connect to the EM/MPO2.

FIRMWARE

The firmware within the ENC2 consists of two parts: the device part, and the TCL part. The device part (standard IQ2v1.0 firmware) consists of a number of standard Trend configuration modules, and functions in exactly the same way as a Trend IQ Controller. Some of these modules have already been pre-configured as explained in the strategy section. The remaining modules may be configured in the normal way. The TCL part runs the TCL script which communicates with the EM/MPO2, performs necessary calculation, and places the reading into the analogue array.

Configuration: The device part of the ENC2 uses the standard IQ configuration mode which enables configuration via the network. Alternatively the SET utility can be used but the existing special strategy should first be uploaded before adding to it using SET. The modified strategy can then be downloaded to the controller by SET (or PowerTool). SET (or PowerTool) can also be used to upload, and download IQ2 files for backup purposes.

Communications: The ENC2 is connected to Trend devices via the Trend Network, and to the EM/MPO2 via an RS485 link.

Modules: The strategy within the device part consists of a number of individual functional blocks known as configuration modules. These blocks can be linked in various combination to perform manipulation of parameters from the EM/MPO2 and to service the I/O. The table lists the different types of configuration modules and the number of each type available within the ENC2.

Module Type	Number	Module Type	Number
Sensor	32	Critical Alarm	4
Sensor type	8	Alarm History	20
Loop	16	IC Comms	16
Function	90	Digital Inputs	32
Logic	90	Fast Sequence	8
Driver	12	Zone	5
Knob	30	Schedule	8
Switch	20	Calendar	20
Sensor log	20	User Password	6
Sequence step	240	Sequence time	1 s
Analogue Nodes	255	Digital Nodes	505

Full details of the modules are given in the IQ Configuration Manual and Addendum, however, only refer to addendum details for IQ2v1.0. The ENC2 contains the normal IQ2v1.0 features as described in IQ Configuration Manual Addendum: Engineers Journal (J), I/O Summary (i/o) Loader Issue (R(c),'c' lower case), Serial Number (R(s), 's' lower case), Supply Frequency Option, Enhanced Logging.

Differences between the modules covered in the manuals and the ENC2's modules are described below:

Address module: The address module has a 'sUpervisor port addr' parameter which is ignored because the port is used for connection to the EM/MPO2.

TCL port: This is pre-configured in the ENC2 to communicate with the EM/MPO2.

STRATEGY

The strategy is pre-configured, partially by the TCL script, and partially by module configuration.

Strategy Items (Inputs, Knobs, Switches)

Items		Label	Units	Default	Note
Inputs	I1	Ext Max Dem Sync Pls		0	Sync on contact closure if W1=1
	I9	Meter Comms Fail		0	0=no data received, 1=meter present
Switches	W1	Enable Ext Sync		0	Sync max demand either from I1 (W1=1) or internal timing pulse (W1=0)
	W2	Max Demand Reset		0	W2=1 resets 0.5 Hr maximum demand (kW, kVA, kVAr)
	W3	Totalisor Reset		0	W3=1 resets totalisors (MWh, MVAh, MVAr usage)
Knobs	K1	Int pulse time delay	Sec	0	Sets delay on internal pulse used for max demand sync if W1=0 (range 0 to 1799)

I9, Meter Comms Fail: The TCL part sets digital input 9 to indicate the meter communication state; (0 = No data received from meter in previous minute, 1 = meter present). I9 generates the alarm "Meter Comms Fail" when it changes to state 0.The fail condition is detected by the strategy (byte 32 bit 0) and it sets all readings from the meter to zero, and any derived values (i.e. sensors 21 to 29) are not incremented.
Note that care should be taken in interpreting calculated values after communication failure due to the way they are calculated.

I1, W1, K1, Demand Period Synchronisation: The demand period is set to a half hour by default. The start of the period is normally synchronised to an internal half hour pulse (W1=0), but there is an option to use an external contact closure connected to input 1 (I1) by setting W1 to 1. If the internal pulse is used, it can be delayed by K1 by up to 29 m, 59 s, to synchronise with the electricity meter. The start of the period zeroes the kWh, kVA, and kVArh consumed in the half hour.

W2, Max. Demand Reset: The half hour maximum demand values (kVA, kW, kVAr) are reset by setting W2 to 1.

W3,Totalisor Reset: The totalised values (MWh, MVAh, MVArh) are reset by setting W3 to 1

Sensors and Nodes
Sensor units and labels are set up as shown in the sensor table below.

Sensor	Label	Range	Units
1	Mean Phase ToPhase V	0-32000	V
2	Avg Phase Current	0-32000	A
3	Active Power	0-3200000	W
4	Power Factor Cos Phi	-1 to +1	
5	Red Phase Voltage	0-32000	V
6	Yellow Phase Voltage	0-32000	V
7	Blue Phase Voltage	0-32000	V
8	Red Phase Current	0-32000	A
9	Yellow Phase Current	0-32000	A
10	Blue Phase Current	0-32000	A
11	Red Phase Power	0-3200000	W
12	Yellow Phase Power	0-3200000	W
13	Blue Phase Power	0-3200000	W
14	Apparent Power	0-3200000	VA
15	Reactive Power	0-3200000	VAr
16	Frequency	20-90	Hz
17	Active Energy Cons	0-3200000	MWh
18	Reactive Energy Cons	0-3200000	MVAr(h)
19	Apparent Power Peaks	0-3200000	kVA
20	Active Power Peaks	0-3200000	kW
21	kWh cons in Half Hr	0-3200000	kWh
22	kVArh cons in HalfHr	0-3200000	kVAr(h)
23	kVA HalfHrMax Demand	0-3200000	kVA
24	kW HalfHr Max Demand	0-3200000	kW
25	kVAh cons in Half Hr	0-3200000	kVAh
26	kVAr HalfHrMaxDemand	0-3200000	kVAr
27	MWh Usage	0-3200000	MWh
28	MVArh Usage	0-3200000	MVAr(h)
29	MVAh Usage	0-3200000	MVAh

Sensors table

Note that the units can only be up to four characters long, thus as MVArh and kVArh are 5 characters long, the last character (h) is lost. This is indicated by (h) in the tables.
Note that if both V and A are at maximum range, then the maximum kW will be exceeded.
The TCL part receives the EM/MPO2 values and places them into analogue nodes 1 to 16, and 33 to 60 (excluding 47 to 52). **Sensors 1 to 16** monitor nodes A1 to A16 directly. **Sensors 17 to 29** monitor values calculated by the strategy modules.

The values placed into nodes A33 to A60 by TCL are shown in the nodes table below.

Node	Label	Range	Units
33	Red Phase Power Factor Cos Phi	-1 to +1	
34	Yellow Phase Power Factor Cos Phi	-1 to +1	
35	Blue Phase Power Factor Cos Phi	-1 to +1	
36	Red Phase Reactive Power	0-3200000	VAr
37	Yellow Phase Reactive Power	0-3200000	VAr
38	Blue Phase Reactive Power	0-3200000	VAr
39	Red Phase Apparent Power	0-3200000	VA
40	Yellow Phase Apparent Power	0-3200000	VA
41	Blue Phase Apparent Power	0-3200000	VA
42	Red Phase Current Crest Factor	0-10	
43	Yellow Phase Current Crest Factor	0-10	
44	Blue Phase Current Crest Factor	0-10	
45	+ve 3 Phase Active Energy Cons.	0-3200000	kWh
46	+ve 3 Ph. Reactive Energy	0-3200000	kVAr(h)
x			
53	3 Phase Avg Reactive Power	0-3200000	VAr
54	3 Phase Avg Apparent Power	0-3200000	VA
55	3 Phase Avg Active power	0-3200000	W
56	3 Phase Apparent Power Peaks	0-3200000	VA
57	3 Phase Active Power Peaks	0-3200000	W
58	-ve 3 Phase Energy	0-3200000	kWh
59	-ve 3 Ph Reactive Energy	0-3200000	kVArh
60	Blue Phase Energy Cons	0-3200000	kWh

Nodes table

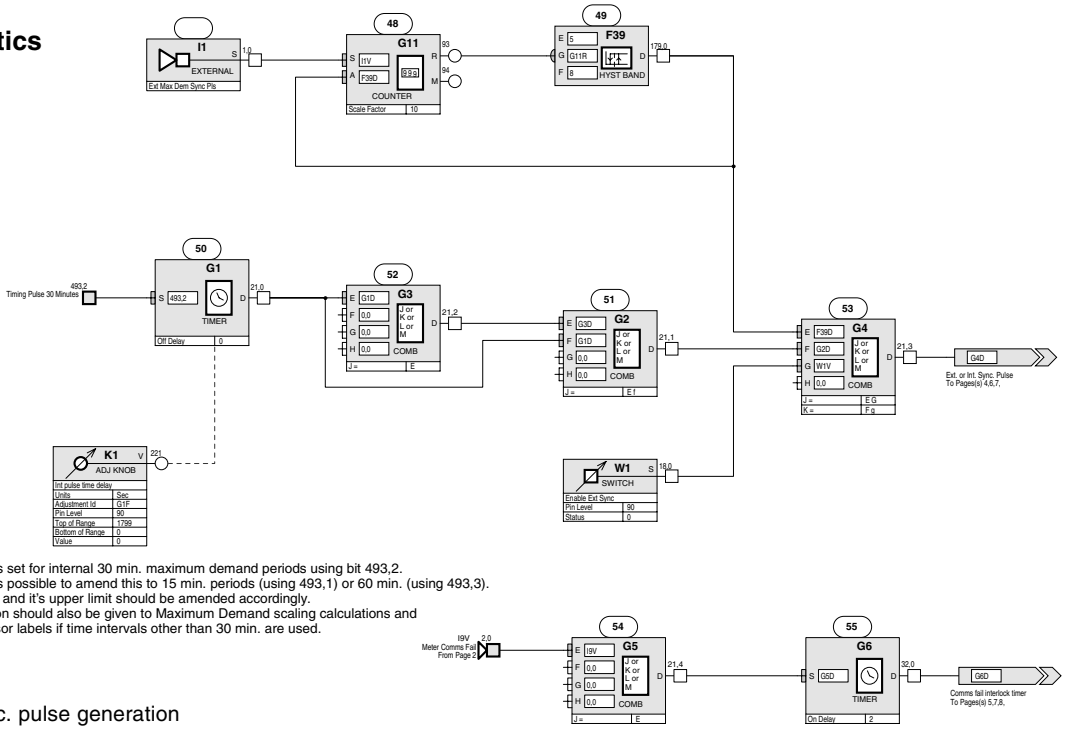
Analogue nodes do not have labels or units so these would have to be set up in the supervisor.
Sensors **17, 18, 19, 20** are set to the values of nodes 45, 46 , 56, 57 respectively divided by 1000 (e.g. converting kWh into MWh, and VA into kVA).
Sensors **21, 22** measure active, and reactive energy consumed in a half hour by monitoring the changes in nodes 45 and 46 respectively. **Sensor 25** measures apparent energy consumed in a half hour by integrating sensor 14 and dividing by 1000. Sensors **21, 22, 25** are reset to zero at the beginning of each half hour period by the synchronisation pulse.
Sensors 23, 24, 26 measure apparent, active, and reactive, half hour maximum demand by keeping the maximum values of sensors 25, 21, and 22 respectively (multiplied by 2 to give full power units e.g kW). They are reset to zero by W2.
Sensors 27, 28, 29 keep totalised values of sensors 3, 15 and 14 (divided by 1 million) respectively; they are reset to zero by W3.
Nodes 45, 46, 56, 57, 58, 59 and 60 can be reset to zero by EM/MPO2 front panel buttons (see VIP Energy User Manual).
Nodes 58 and 59 will only give negative energy (i.e. power generation back into supply) if set for delta connection or for Star connection with Cogeneration 4 (COG4 is set by front panel buttons - see VIP Energy User Manual). If set for star without COG4 (i.e. standard setting), nodes 58 and 59 measure Red and Yellow Phase Energy Consumptions (kWh) respectively.
Node 60 will only measure if set for star without COG4 (i.e. standard setting).
The definitions of the measurements (e.g. crest factor, power peaks) are given in the VIP Energy User Manual.

Plotting Channels

Sensors	Description	Plot Channels	Period	No of records
1 to 16	see table	1 to 16	1 min	1000
21	kWh cons in half hr	19	30 mins	1000
22	kVarh cons in half hr	17	30 mins	1000
25	kVAh cons in half hr	18	30 mins	1000
28	MVArh Usage	20	30 mins	1000

STRATEGY

Schematics



The above is set for internal 30 min. maximum demand periods using bit 493,2.
However it is possible to amend this to 15 min. periods (using 493,1) or 60 min. (using 493,3).
N.B. Knob 1 and it's upper limit should be amended accordingly.
Consideration should also be given to Maximum Demand scaling calculations and certain Sensor labels if time intervals other than 30 min. are used.

Fig 1. Sync. pulse generation

The maximum demand period is based on the 30 minute timing pulse bit 493,2. As indicated in fig 1, the period could be changed to a 15 m or 60 m period. Knob 1 (K1) sets a delay (0 to 1799 s, 29 m 59 s) on the standard timing pulse to specify the start of the maximum demand period. This is done by a combination of logic modules G1, G2, and G3. G1 produces the delay on the falling edge of the timing pulse as specified by K1. G2 and G3 together then produce a 1s pulse at the end of the delayed pulse. Logic module G4 then allows switch 1 (W1) to select either this pulse, or an external synchronisation pulse connected via digital input 1 (I1). G11 and F39 are used to ensure that the input to G4 remains set for one sequence cycle, so that G4 will gate it through if appropriate. The meter communication state is indicated by I9; if I9=1, meter communications are OK. This is filtered by G6 so that it must stay OK for 2 secs for it to set bit 32,0. This bit is used to add zero to the power values (W, VA, VAr) and zero increment to energy consumed values (Wh, VArh) while the meter communications are faulty.

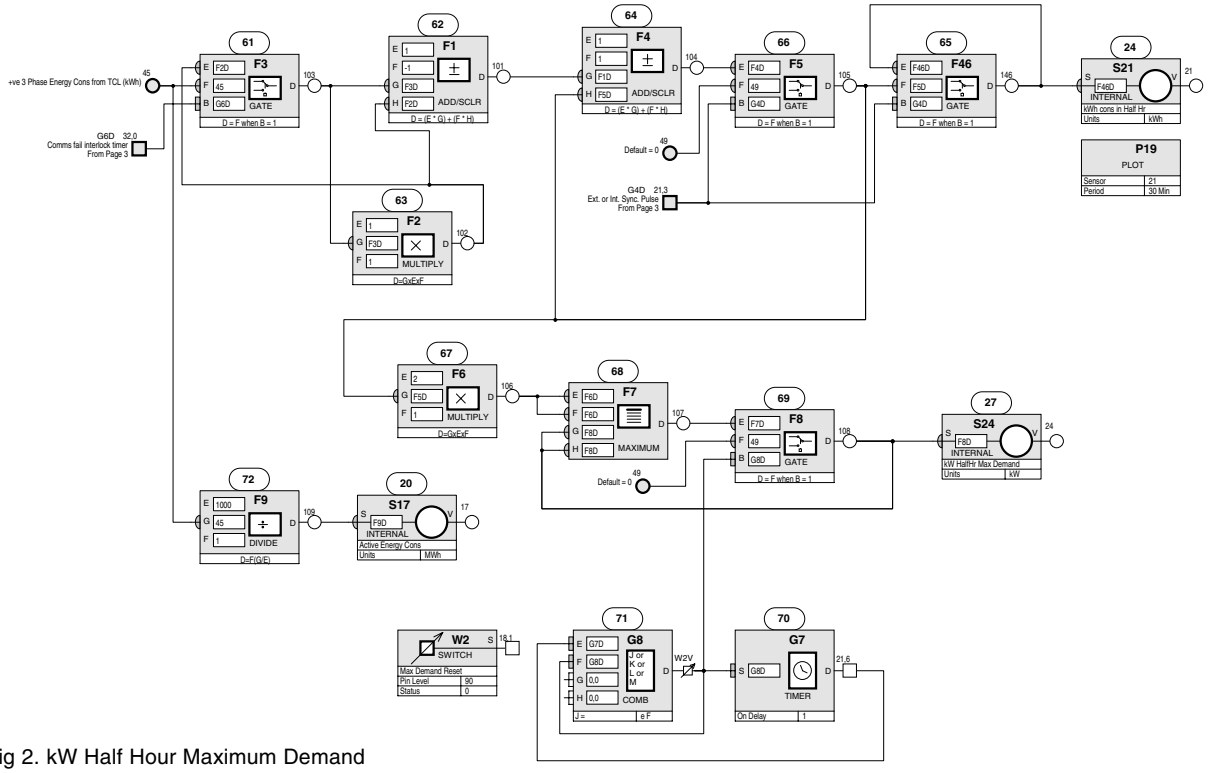


Fig 2. kW Half Hour Maximum Demand

In Fig 2., the meter input on node 45 (Positive 3 phase Active Energy Consumed - kWh) is divided by 1000 by F9 to give Active Energy Cons (MWh) which is monitored by S17. F2 is serviced after F3 and F1, so its output holds the previous value of node 45. F3 normally gates through the meter input on node 45, but gates through the previous value from F2 if there is a communications failure with the meter. F1 takes the previous value of node 45 from the current value so that the increase in value can be added into the accumulating total by function module F4. F46 is serviced before F5, so when the sync pulse occurs F46 passes the total through to S21, and F5 then passes through zero which clears the total for the start of the next period. The total, 'kWh cons in Half Hr' is monitored by S21; it will only show the total accumulated before the last sync pulse.
F6 multiplies the half hour consumption by two to give a true kW power value. F7 passes this value through if it is greater than the previous maximum held by the F7/F8 combination. This produces the 'kW HalfHr Max. Demand' which is monitored by S24. Switch 2 (W2), the Maximum Demand Reset, is inserted between modules G8 and G7 which ensure that the switch is set back to zero after one cycle of the sequence table. W2 causes F8 to gate through zero which resets the kW HalfHr Max. Demand.

Schematics (continued)

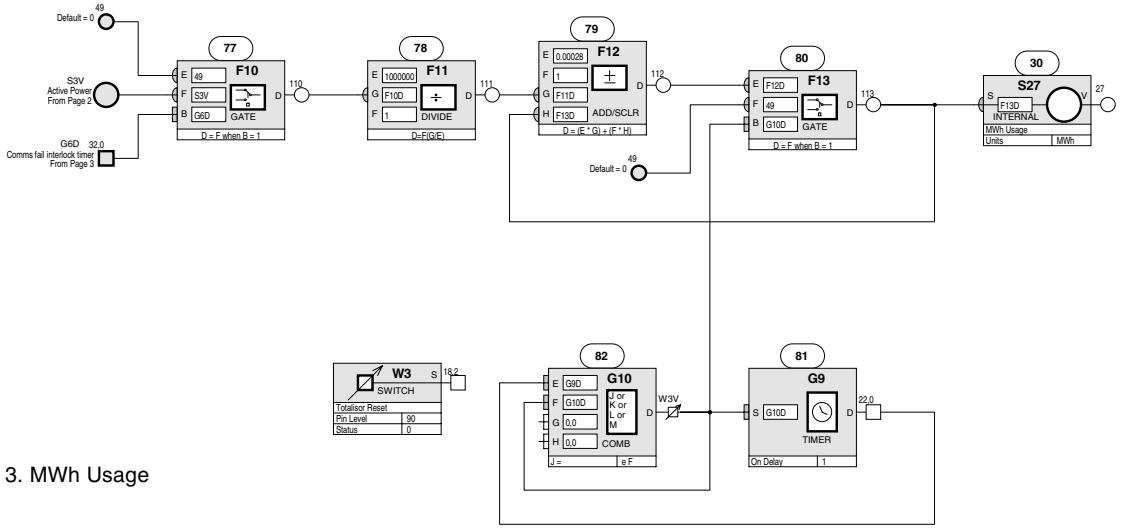


Fig 3. MWh Usage

In Fig. 3, F10 will normally gate through S3, Active Power (W), but if the meter communications fail, it will gate through zero. The active power is divided by 1,000,000 by F11, and then multiplied by 0.00028 (divided by 3600 - correct to 5 places after decimal point) within F12. The division by 3600 is to convert the MW value into MWh consumed per second, and then F12 and F13 together add this to the usage total every second to produce the totalised MWh Usage monitored by S27. Switch 3 (W3), the Totalisor Reset, is inserted between modules G10 and G9 which ensure that the switch is set back to zero after one cycle of the sequence table. W3 causes F13 to gate through zero which resets the MWh Usage.

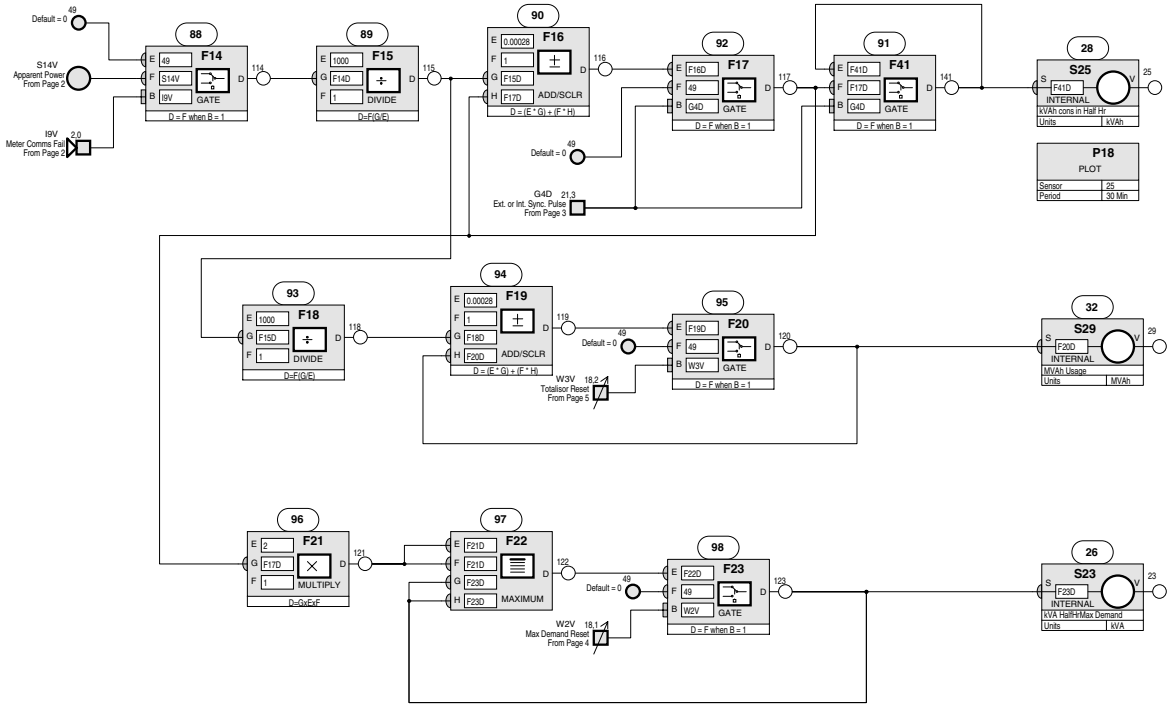


Fig 4. kVA Half Hour Maximum Demand

In Fig. 4, F14 will normally gate through S14, Apparent Power (VA), but if the meter communications fail, it will gate through zero. The active power is divided by 1000 by F15, and then multiplied by 0.00028 (divided by 3600 - correct to 5 places after decimal point) within F16. The division by 3600 is to convert the kVA value into kVAh consumed per second, and then F16 and F17 together add this in to the accumulating kVAh total every second. F41 is serviced before F17, so when the sync pulse occurs F41 passes the total through to S25, and F17 then passes through zero which clears the total for the start of the next period. The total, 'kVAh cons in Half Hr' is monitored by S25; it will only show the total accumulated before the last sync pulse.
The apparent power from F15 (kVA) is divided by 1000 by F18 and then multiplied by 0.00028 (divided by 3600 - correct to 5 places after decimal point) within F19. The division by 3600 is to convert the MVA value into MVAh consumed per second, and then F19 and F20 together add this in to the usage total every second to produce the totalised MVAh Usage monitored by S29. Switch 3 (W3), the Totalisor Reset, causes F20 to gate through zero which resets the MVAh Usage. F21 multiplies the half hour consumption by two to give a true kVA power value. F22 passes this value through if it is greater than the previous maximum held by the F22/F23 combination. This produces the 'kVA HalfHrMax Demand' which is monitored by S23. Switch 2 (W2), Maximum Demand Reset, causes F23 to gate through zero which resets the kVA HalfHrMax Demand.

Schematics (continued)

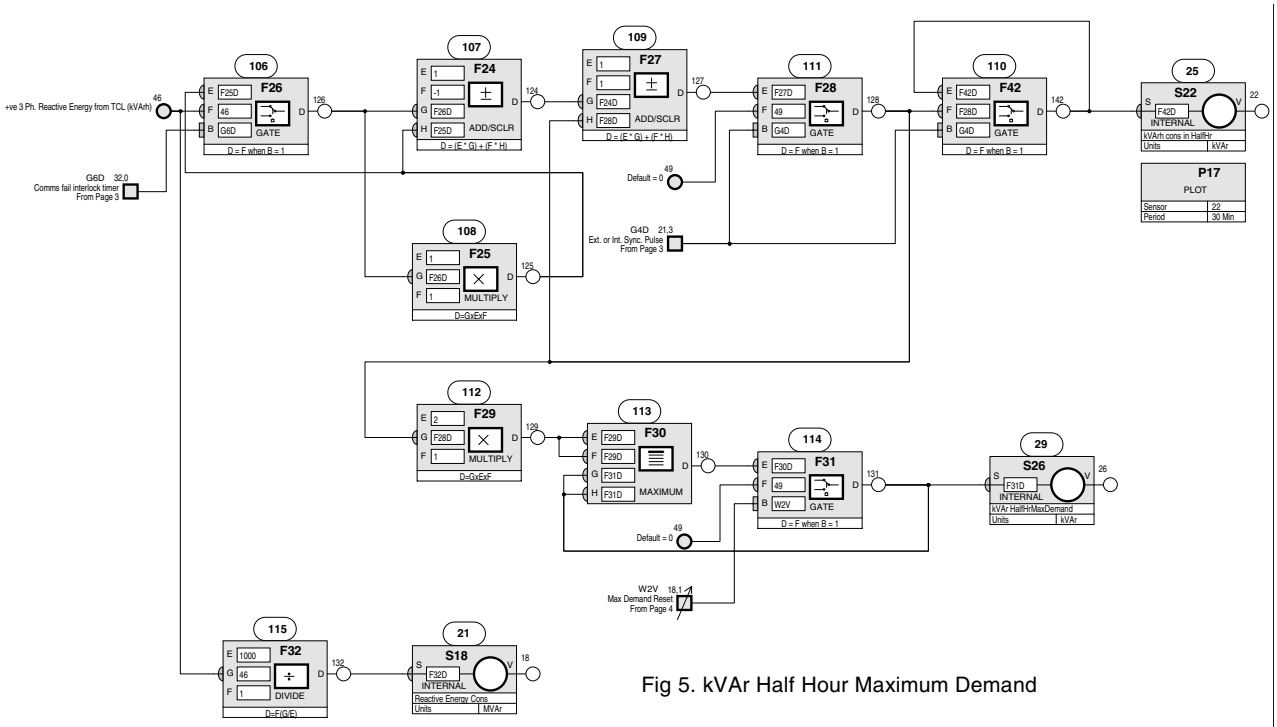


Fig 5. kVAr Half Hour Maximum Demand

In Fig 5., the meter input on node 46 (Positive 3 phase Reactive Energy Consumed - kVArh) is divided by 1000 by F32 to give Reactive Energy Cons (MVArh) which is monitored by S18. F25 is serviced after F26 and F24, so its output holds the previous value of node 46. F26 normally gates through the meter input on node 46, but gates through the previous value from F25 if there is a communications failure with the meter.F24 takes the previous value of node 46 from the current value so that the increase in value can be added into the accumulating total by function module F27. F42 is serviced before F28, so when the sync pulse occurs F42 passes the total through to S22, and F28 then passes through zero which clears the total for the start of the next period. The total, 'kVArh cons in HalfHr', is monitored by S22; it will only show the total accumulated before the last sync pulse.
F29 multiplies the half hour consumption by two to give a true kVAr power value. F30 passes this value through if it is greater than the previous maximum held by the F30/F31 combination. This produces the 'kVAr HalfHrMaxDemand' which is monitored by S26. Switch 2 (W2), Maximum Demand Reset, causes F31 to gate through zero which resets the kVAr HalfHrMaxDemand.

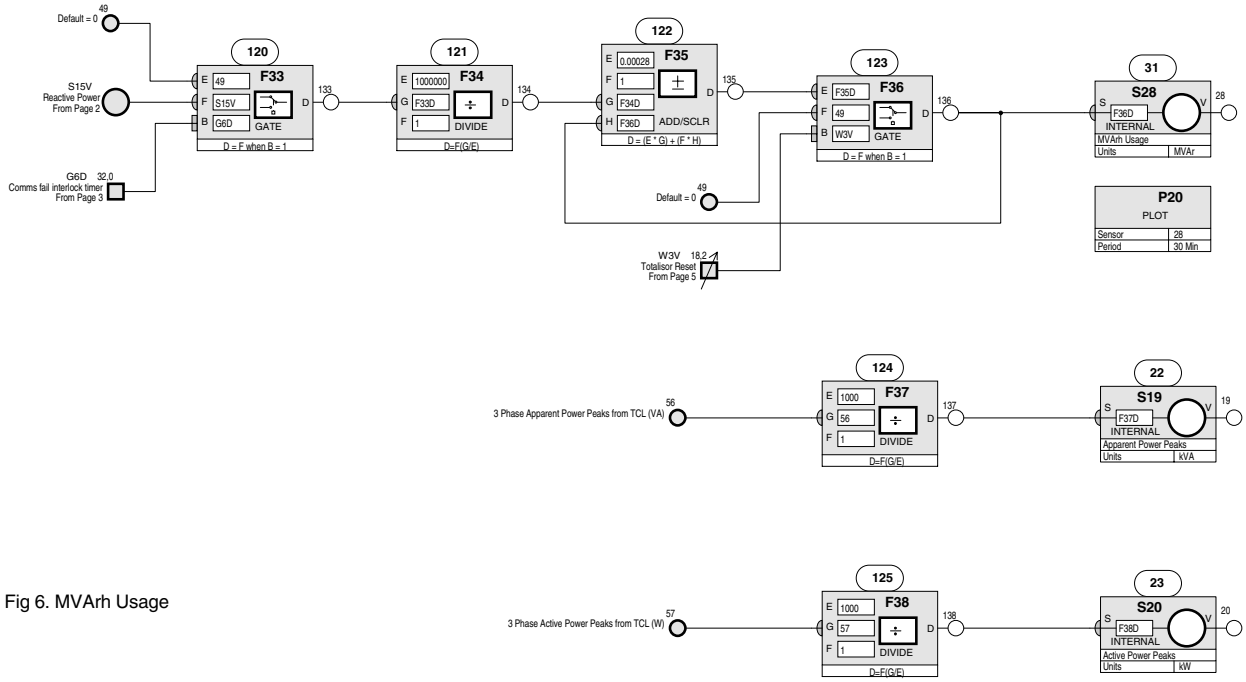


Fig 6. MVArh Usage

In Fig. 6, F33 will normally gate through S15, Reactive Power (VAr), but if the meter communications fail, it will gate through zero. The active power is divided by 1000,000 by F34, and then multiplied by 0.00028 (divided by 3600 - correct to 5 places after decimal point) within F35. The division by 3600 is to convert the MVAr value into MVArh consumed per second, and then F35 and F36 together add this to the usage total every second to produce the totalised MVArh Usage monitored by S28. Switch 3 (W3), the Totalisor Reset causes F36 to gate through zero which resets the MVArh Usage.
F37 takes the 3 Phase Apparent Power Peaks (VA) from node 56 and divides by 1000 to produce the Apparent Power Peaks (kVA) monitored by S19.
F38 takes the 3 Phase Active Power Peaks (W) from node 57 and divides by 1000 to produce the Active Power Peaks (kW) monitored by S20.

Strategy Version:

Attribute K in the Address module is set to the strategy version number.

INSTALLATION

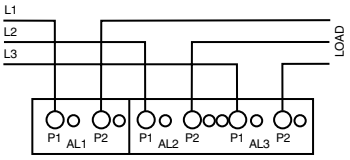
CONNECTIONS

EM/MPO2

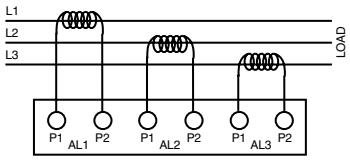
Current Connections

Single part screw terminals

Direct Connection I ≯ 5A

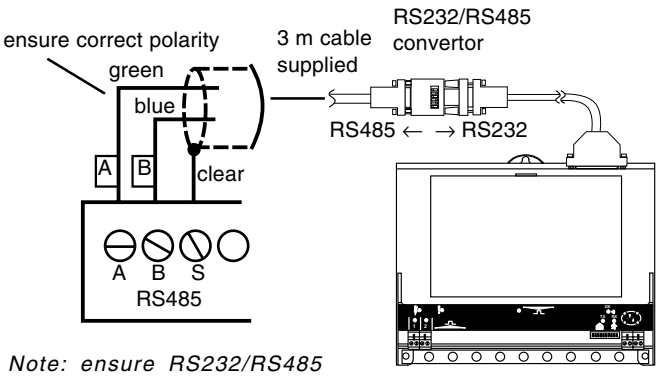


Indirect Connection using CTs



CT primary I ≯ 99999 A
Secondary I = 1, 2, 2.5, 5 A

Connection to ENC2

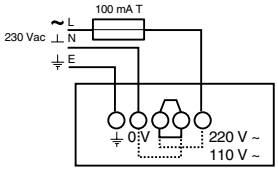


Note: ensure RS232/RS485 convertor is connected correct way round.

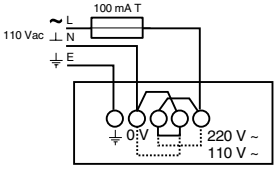
Meter Supply

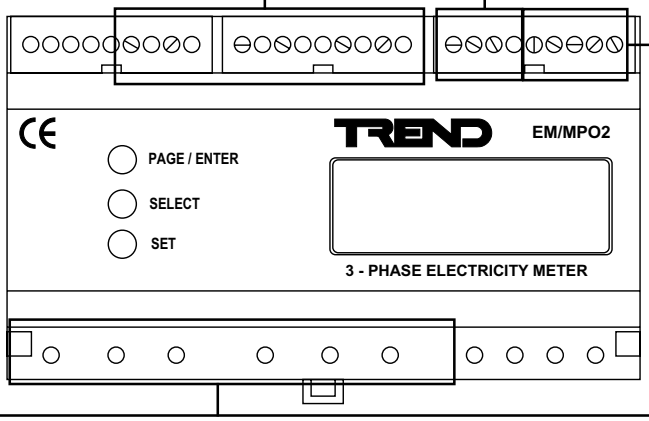
Single part screw terminals.

200 to 240 Vac Supply



100 to 120 Vac Supply

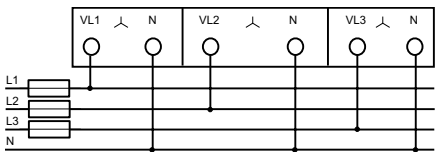




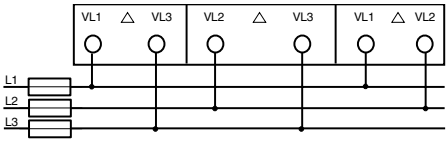
Voltage Connections

Single part screw terminals

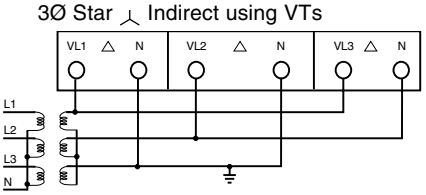
3Ø Star ⅄ direct



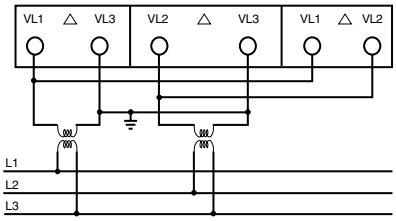
3Ø Delta △ Direct V ≯ 550 V



3Ø Star ⅄ Indirect using VTs



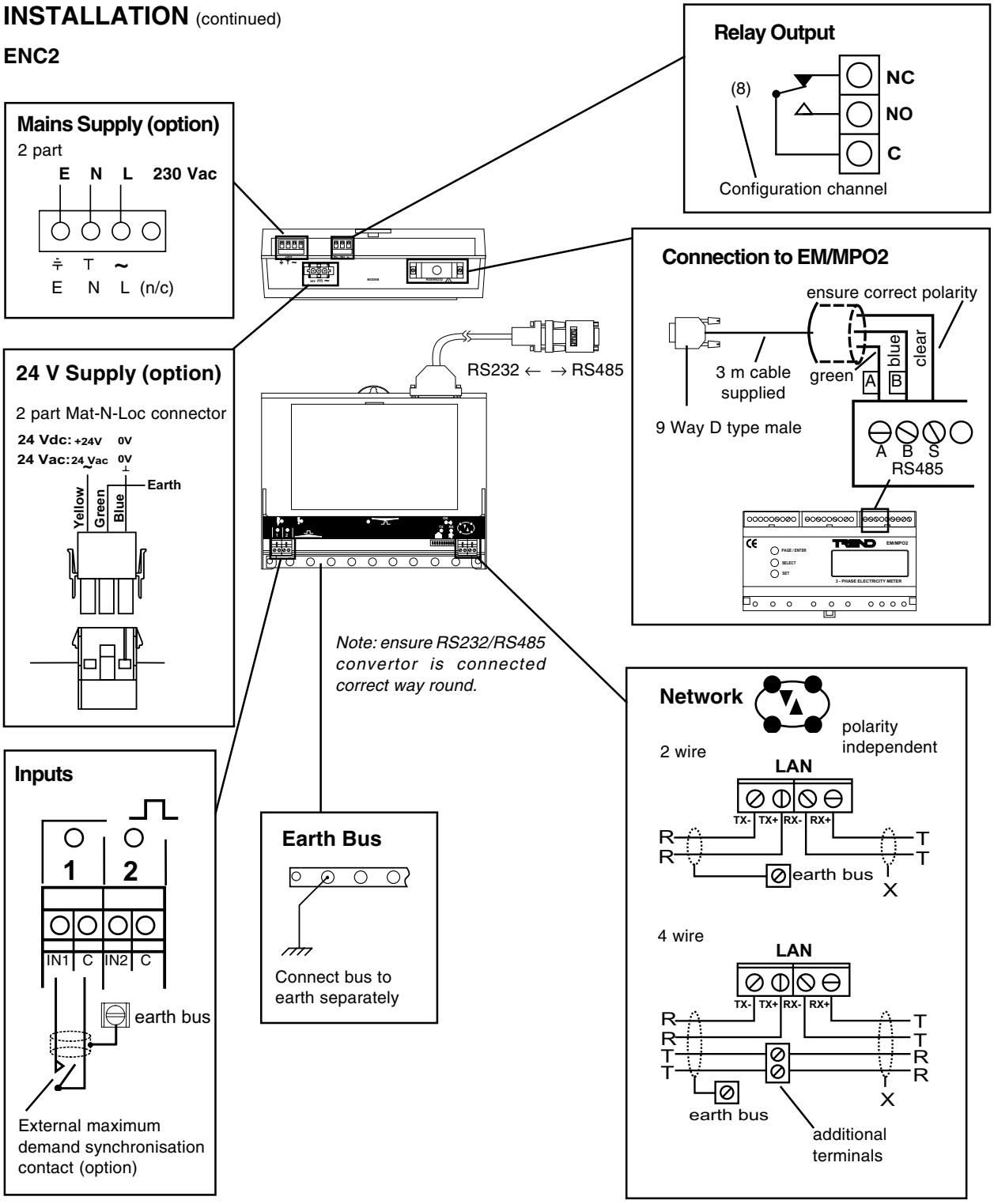
3Ø Delta △ Indirect using VTs



VT primary V > 99999 V
secondary V = 57.7, 63.5, 100, 110, 115, 120, 173, 190, 200, 220 V

INSTALLATION (continued)

ENC2



EM/MPO2
Fix DIN rail
Mount unit on DIN rail
Connect power
Connect current (or CTs)
Connect voltage (or VTs)
Connect to ENC2
Switch On
Configure meter

ENC2
Mount unit in position
Connect power (do not power up)
Terminate network, leave unconnected
Terminate I/O, leave unconnected
Specify network address and baud rate
Power up
Connect network and check
Configure strategy
Connect I/O and check
Backup configuration

Further installation details are given as follows:
EM/MPO2 Installation Instructions, TG200269. NBOX/ENC2 Installation Instructions, TG200270. The full configuration of the EM/MPO2 is covered by the VIP Energy User Manual supplied with the EM/MPO2. Installation in a panel using the ACC/EM/MK Panel Mounting Kit option is covered by the ACC/EM/MK installation instructions, TG200338.

MAINTENANCE

Neither the EM/MPO2 nor ENC2 require any routine maintenance. From time to time the ENC2 will require its backup battery to be changed. This should only be undertaken by a qualified Trend Engineer as it involves a hot-replacement method. The meter interface script program (TCL) is lost if the battery is removed during power down. Contact your Trend representative for advice.

DISPOSAL

COSHH ASSESSMENT FOR DISPOSAL OF NODE CONTROLLER. The only part affected is the lithium battery which must be disposed of in a controlled way.

RECYCLING.
All plastic and metal parts are recyclable. The printed circuit board may be sent to any PCB recovery contractor to recover some of the components for any metals such as gold and silver.

ORDER CODES

EM/MPO2	Multi-parameter Electricity Meter including installation instructions and VIP Energy User Manual.
ACC/EM/MK	Mounting kit to enable the EM/MPO2 to be panel mounted including installation instructions. *Note only the EM/MPO2 meter will fit in this enclosure.*
NBOX/ENC2/230	Energy Node Controller in plastic box for 230 Vac supply including RS232/RS485 convertor and its cable, 3 m cable to EM/MPO2, earth bus, earth bus screws, and installation instructions.
NBOX/ENC2/24	Energy Node Controller in plastic box for 24 Vac or dc supply including RS232/RS485 convertor and its cable, 3 m cable to EM/MPO2, earth bus, earth bus screws, and installation instructions.

Current transformers

Current transformers (CTs) should be ordered separately. A range of split core CTs are available from Trend as described in the Current Transformers data sheet TA102139.

Voltage transformers

For voltage supplies higher than 550 V, voltage transformers (VTs) are required. They should be ordered separately. *Please note that Trend do not supply voltage transformers.*

SPECIFICATIONS

EM/MPO2

Electrical

Supply voltage	:100 to 120 Vac, 200 to 240 Vac ±10%
Meter consumption	:8 VA
Metered voltage	:Up to 550Vrms direct or up to 999999 Vrms using VTs (20 to 600Hz.
Overload voltage	:2000 Vrms peak (60 secs).
Metered current	:Up to 5 A direct or up to 999999 A using CTs (20 to 600 Hz).
Overload current	:20 x full scale (1 sec).
Measurement accuracy	:± (0.3% Full Scale + 0.3% Reading) (18°C to 25°C). Add ±0.02% Full Scale per °C outside this range.
Reset button	:Power peaks (kVA and kW) and energy counters (kVArh and kWh) are reset using the front panel reset button.
CT ratio selection	:Primary 1A to 999999A, secondary 1, 2, 2.5, 5A.
VT ratio selection	:Primary 1V to 999999V secondary 57.7, 63.5, 100, 110, 115, 120, 173, 190, 200, 220V.
Backup	:Max. demand , energy meters, setup, and clock information is protected for up to 40 years by an internal EEPROM.
Meter burden	:0.07 Ω for each CT.
Measuring method	:Fixed sampling and analogue/digital conversion.
Sampling frequency	:1.25 kHz.
No. of samples/phase	:125 (100 msec).
Measuring interval	:1.2 sec.
Zero self correction	:every 1.2 sec.
Inputs	
Number of scales	:2 voltage scales, 3 current scales.
Auto scale change	:Response time at scale change 1.2 s, passage to scale above occurs at 105% of scale activated, passage to scale below occurs at 20 % of scale activated.
Lithium battery	:3V, 280 mAh.
Communication	:To ENC2, RS485, 9600 baud, no parity, 2 stop bits.

Environmental

EMC emissions	:EN50082-1, EN55011
EMC immunity	:EN50082-2, EN55022
Safety standards	:IEC 348, VDE 411, class 1 for operating voltage ≤ 650 VAC rms, IEC 1010 600 V.
Ambient limits	
Storage	:-20 °C to +70 °C
Operating	:-10 °C to +60 °C
Humidity	:20 to 80 %RH non-condensing

Mechanical

Dimensions	:210.5 mm x 90 mm x 58 mm
Protection	:IP20 (IP40 with front panel)
Fixing	:DIN rail 35 mm
Weight	:1kg

SPECIFICATIONS (continued)

ENC2

Electrical

CPU :68334 32 bit micro-controller.
CPU Speed :16.78 MHz.
Cycle time :1 s.
Memory :128 kbyte battery backed SRAM, and 256 kbyte Flash.
Supply voltage
/230 :230 Vac +15%, -10%, 50 to 60 Hz.
/24 :24 Vac ±10%, 50 or 60 Hz or 24 Vdc (24 V to 36 Vdc)
Consumption :13 VA max.
Fusing :No replaceable fuses required. All protection self-resetting.
Battery backup :Battery maintains time, and logged data with mains off for at least 5 years.
Battery :Saft LM2450, 3 V, or equivalent.
Clock accuracy :30 s per month (typical).
Network transmission :20 mA serial 2 wire current loop, opto-isolated, polarity independent receiver, balanced transmitter.
Network distance :Dependent on cable type, see table below:

Cable	1k2 baud	4k8 baud	9k6 baud	19k2 baud	No. of Wires
Belden 9182	1000 m	1000 m	1000 m	700 m	2
9207	1000 m	1000 m	1000 m	500 m	2
8761	1000 m	1000 m	700 m	350 m	2
8723	1000 m	1000 m	500 m	250 m	4

Network baud rate :Selectable by links 1k2, 4k8, 9k6, 19k2 baud - set to be same as other nodes on local Lan.
Network address :Selectable by board switches 116 nodes addressable (4 to 118, excluding 9, 10). Uses selected address and selected address plus 1; both addresses must be unique on local Lan
Inputs :Input channels 1 & 2, digital inputs. Volt free contact. Count rate 30 Hz. Wetting current = 3 mA nominal. 5 V supply. Status LED per channel (ON = closed contact).
Relay Output :External connection 16 Configuration channel OP8. 1 pole changeover relay. Output rated for 240 Vac single phase only 8 A (resistive load), 5A (inductive, cos∅ = 0.4), 30 Vdc at 5 A (resistive load), and 20 Vdc at 5 A (inductive load). For 24 Vdc (inductive load) reduce to 2 A. Arc suppression recommended, see Relay Output Arc Suppression Installation Instructions, TG200208). Status LED per channel (ON = relay energised).

Indicators
Inputs :(yellow) Indicates status (ON= contact closed)
Relay output :(yellow) ON if relay energised
(power) :(green) ON when supply is connected
(watchdog) :(red) ON if controller has a software fault
OK (network) :(green) ON if network is operating. Flashes if prohibited controller network address set (0, 2, 3, >119).
RX :(yellow) ON if current is entering the network receiver
TX :(yellow) ON if current is flowing from network transmitter
Note that the (watchdog) LED flashes momentarily on power up

Mechanical

Dimensions :230 mm x 70 mm x 210 mm (plus RS232/RS485 convertor and cables)
Material
Box :ABS
Terminal cover :Clear Styrolux
Protection :IP30
Weight :1.4 kg
Connectors
/230 :2 part connector for 0.5 to 2.5 mm^2 cross section area cable.
Network :2 part connector with 4 screw terminals for 0.5 to 2.5 mm^2 cross section area cable.
I/O :2 part connector with 2 screw terminals for 0.5 to 2.5 mm^2 cross section area cable.
EM/MPO2 :RS232/RS485 convertor connected to ENC2 by 25 Way D type female to 9 Way D type male 40 mm cable (supplied). RS232/RS485 convertor connected to EM/MPO2 by 9 Way D type male to stripped ends 2 core 3 meter cable (supplied). The stripped ends are to be screwed into the EM/MPO2 terminals.

Environmental

EMC
Emissions :EN50081-1.
Immunity :EN50082-2.
Safety :EN61010.
Ambient limits
storage :-10 °C to 50 °C
operating :0 °C to 45 °C
humidity :0 to 90 %RH non-condensing
Flammability
Casing material :Flame retardance, UL99V0
Glow wire test, UL746A(3)
Version
ENC2 :strategy v1.4.2
:firmware (IQ22x) v1.3
:RS232/RS485 convertor K2-ADE